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(21) International Application Number: PCT/NL95/00217 (22) International Filing Date: 19 June 1995 (19.06.95) (30) Priority Data: 9401033 23 June 1994 (23.06.94) NL (71) Applicant (for all designated States except US): MAASLAND N.V. [NL/NL]; Weverskade 10, NL-3155 PD Maasland (NL). (72) Inventors; and (75) Inventors/Applicants (for US only): VAN DER LELY, Olaf [NL/CH]; Bann, CH-6312 Steinhausen (CH). VAN DEN BERG, Karel [NL/NL]; Boterbloemstraat 5, NL-2971 BR Bleskensgraaf (NL). (74) Agent: MULDER, Herman; Weverskade 10, NL-3155 PD Maasland (NL).		(81) Designated States: JP, NZ, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE). Published <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
(54) Title: A CONSTRUCTION INCLUDING AN IMPLEMENT FOR AUTOMATICALLY MILKING ANIMALS (57) Abstract A construction including an implement for milking animals, such as cows, has one or more milking boxes (1), at least one automatic feeding system (5), at least one animal identification system (11, 12) connected to a computer means (4). In order to have the supply of fodder to the animals proceed to the best possible extend, during the milking of an animal, a quantity of fodder, adjusted to said animal, is automatically supplied to said animal by a computer-controlled feeding system. This quantity of fodder can furthermore be supplied in such a manner that it is distributed over the expected milking period.		

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A CONSTRUCTION INCLUDING AN IMPLEMENT FOR AUTOMATICALLY
MILKING ANIMALS

5 The present invention relates to a construction including an implement for milking animals, such as cows, having one or more milking boxes, at least one automatic feeding system and at least one animal identification system connected to a computer means.

10 Automatic feeding systems and their use with an implement for automatically milking animals are known. In order to optimize the performance of such implements as much as possible, the construction as defined in the opening paragraph is characterized in that, during the milking of an animal, a quantity of fodder, adjusted to said animal, is automatically supplied to said animal by a computer-
15 controlled feeding system. This quantity of fodder, adjusted to each animal individually, is preferably supplied such that the flow of fodder is interrupted as little as possible. An animal reporting at or in a milking box for being milked, is identified there with the aid of the animal identification
20 system, whereafter, on the basis of the data stored of this animal in the computer, it is determined how much fodder can be supplied to this animal during the time it is being milked. Thus, the quantity of fodder to be supplied is adjusted to the individual animals, which is beneficial to
25 the quiet behaviour of the herd. The control can be such that the quantity of fodder to be supplied to an animal is fed forward in such a manner that it is automatically distributed over the expected milking period. The invention, therefore,

also relates to an implement for automatically milking animals, such as cows, having one or more milking boxes, at least one automatic feeding system, at least one animal identification system connected to a computer means and one or more milking robots for automatically connecting teat cups to the teats of an animal, the construction then being characterized in that the quantity of fodder to be supplied to an animal is automatically distributed over the expected milking period by a computer-controlled feeding system.

When the length of the milking period of a specific animal is stored in the computer, then, with the aid of the automatic feeding system, the supply of fodder can be controlled such that it is distributed over the milking period to be expected on the basis of the data recorded in the computer. This does not only render it possible to adjust the quantity of fodder to the individual animals, but also that the supply of fodder versus the time is distributed over the expected milking period. Using such a fodder supply mode, adjusted to the individual animals, achieves to an increased extent that the animal feels at ease in a milking box, so that also connecting of the teat cups may be facilitated and the cow will be quiet during the full stay in the milking box.

After an animal has entered a milking box, then, by supplying fodder, the milk reflex can be stimulated and, even when the teat cups have not yet been connected, the animal may already release some milk. In connection therewith, the construction, in accordance with a further feature of the invention, is characterized in that a milking robot includes detection means for determining the position of the teats, and that the control of the feeding system is such that fodder is supplied to an animal as soon as the position of the teats has been determined and/or the teat cups are connected. By ensuring that the supply of fodder is not effected earlier than after the position of the teats has been determined, or the teat cups are connected to the teats of the animal, the milk reflex in response to the supply of fodder is prevented from being stimulated too soon. The invention, therefore, also relates to a construction

including an implement for automatically milking animals, such as cows, having one or more milking boxes, at least one automatic feeding system, at least one animal identification system connected to a computer and one or more milking robots for automatically connecting teat cups to the teats of animal, whilst furthermore detection means are present for determining the position of the teats, the construction then being characterized in that the computer-controlled feeding system provides that fodder is supplied to an animal as soon as the position of the teats has been detected by the detection means and/or the teat cups are connected to the teats.

Connecting of the teat cups will not always proceed without tension for all the animals. It may happen that the teat cups are not connected during the first effort; several efforts may be necessary, which may cause an animal to become agitated, as a result of which it will have to stay for a longer period of time in the milking box. In connection therewith, the construction according to the invention is further characterized in that the control is such that, when connecting of the teat cups takes more time than is customary for the milking robot, the animal automatically receives a quantity of fodder that is adapted to the prolonged period of time it has to stay in a milking box. The invention, therefore, also relates to a construction including an implement for automatically milking animals, such as cows, having one or more milking boxes, at least one automatic feeding system, at least one animal identification system connected to a computer and one or more milking robots for automatically connecting teat cups to the teats of the animals, the construction then being characterized in that the feeding system has a control incorporating the computer, which control is such that, when connecting the teat cups requires a longer period of time than is customary for the milking robot, the animal automatically receives a quantity of fodder that is adapted to the prolonged period of time it has to stay in a milking box.

In accordance with a further feature of the invention, the aforementioned construction is characterized in that in the computer it is recorded which animals were found

difficult to be milked in previous milkings, and that said animals are milked or allowed access to a milking box only or at least as much as possible during preferential hours, e.g. during daytime. For it may be necessary that the farmer must act personally in case of animals which are difficult to milk, e.g. because with young animals at the beginning of their lactation period or due to the shape of the udder, the automatic connecting of the teat cups proceeds with difficulty. It should, however, be avoided that the farmer must be available for that purpose at any moment of a 24 hours' period. The invention, therefore, also relates to a construction including an implement for automatically milking animals, such as cows, having one or more milking boxes, at least one automatic feeding system, at least one animal identification system connected to a computer and one or more milking robots for automatically connecting teat cups to the teats of the animals, the construction then being characterized in that it is recorded in the computer which animals proved to be difficult to milk in previous milkings, and that said animals are milked or allowed access to a milking box only or at least as much as possible during preferential hours, e.g. during daytime.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying sole drawing.

This drawing is a side elevational view of a milking box 1. This milking box is comprised of a railing 2 having an entrance door arranged in the rear wall of the milking box 1, for which reason it is not visible, whilst moreover an exit door 3 is present, in the drawing shown at the leading end of the longitudinal side of the milking box. The implement additionally includes a computer 4, an automatic feeding system 5 and a milking robot 6. The feeding system 5 comprises a feeding trough 7 at the leading wall of the milking box 1, a fodder supply means 8 and a fodder hopper 9. The supply of fodder to the feeding trough 7 is controlled in the fodder hopper 9. For that purpose, the automatic feeding system 5 includes a control, of which the

computer 4 is part. Put differently: with the aid of the computer 4 and the further fodder supply control means in the fodder hopper 9, the supply of fodder fed to an animal in the milking box can be controlled. Animals which are allowed to enter the milking box 1 are fitted with a collar 10, on which a transponder 11 is disposed. This transponder 11 co-operates with a sensor 12 installed near the feeding trough 7. The sensor 12 is connected to the computer 4. The transponder 11 and the sensor 12 constitute an animal identification system. Once an animal has entered the milking box and has advanced sufficiently far, so that it can stick its head into the feeding trough 7, then the distance between the transponder 11 and the sensor 12 is such that communication between these two elements is possible, and the animal can be identified. Via the connection between the sensor 12 and the computer 4 it is possible to obtain access to the data file in the computer 4 of the relevant animal. From this file can inter alia be obtained data which are an indication of the position of the teats of the animal in the milking box 1, so that detection means 13, which in the inoperative state are located outside the milking box 1, can be pivoted by means of a pivotal motion about two vertical shafts 14 and 15 to under the udder of the animal into a defined position, so as to enable the determination of the position of the teats relative to the milking box 1. After the detection means 13 have determined, in co-operation with the computer 4, the position of the teats, the milking robot 5 is controlled such under the control of the computer 4 that teat cups 16 belonging to this robot can be connected to the teats of the animal, whereafter the animal is milked automatically.

In the file in the computer 4, in which all the relevant data about milking of each individual animal are updated, the milk yield per milking turn, optionally even for each udder quarter, is also permanently updated, together with several data about the health condition of the animal, as well as the quantity of fodder supplied during each milking turn and daily to the animal, whilst in the computer it can likewise be determined how much fodder is to be given during each milking turn to yield an optimum milk production.

In other words: the feeding system has a control incorporating a computer, which control is such that, during the period of time an animal is being milked, a quantity of fodder adjusted to this animal is automatically supplied to it. In order to keep the animal quiet during the anticipated milking period, based on the milking periods recorded in the data file of the relevant animal, so that automatic connecting of the teat cups and the subsequent milking operation can be effected without problems, the control must further be such that the quantity of fodder to be fed to an animal is supplied in such a manner that it is automatically distributed over the expected milking period. Although the supply of fodder may be effected at the instant at which the animal has entered the milking box, it may be advantageous to wait therewith until the instant at which the position of the teats is determined or has been determined and the teat cups are being connected. For prior to that instant, the fact whether the animal stands quietly in the milking box may be of less importance, whilst on the other hand there is a risk that, since the supply of food may initiate the milk reflex, the animal releases milk already.

With some animals, the position of the teats can be so unfavourable that connecting of the teat cups proceeds with difficulties, or sometimes does even not succeed at all. The teats can be located very close to each other, or at unequal heights. When connecting of the teat cups does not succeed, then the farmer must be near to interfere, as otherwise the animal is not milked and is driven from the milking box, so that the next time the animal reports again must be waited for. This state of affairs has for its result that the repeated efforts to connect the teat cups to the teats cause the animal to stay in the milking box longer than is normal, so that this fact must be taken into account in the supply of fodder. Therefore, measures have been taken in the computer programme controlling the supply of fodder to take into account, when calculating the quantity of fodder to be supplied to an animal during its stay in the milking box, a longer stay of the animal in the milking box due to the fact that it is difficult to connect the teat cups. To

prevent that the farmer is confronted at any moment of the 24 hours' period with an animal which reports in the milking box and is difficult to be milked, e.g. because problems occur during connecting of the teat cups, it is advantageous to milk these animals only in predetermined preferential hours, more specifically during the daytime. This means that animals, which are difficult to be milked and which report at the milking box, are either not allowed access to the milking box or, when they are allowed to enter the milking box without further measures, provided the milking box is free, are expelled therefrom without having been milked. In the first-mentioned case, i.e. when the animals are not allowed access to the milking box, the sensor 12 will not be disposed at the feeding trough 7 but near to the entrance of the milking box, so that the animals can be identified before they can enter the milking box.

The invention is in no way limited to the embodiment described here; all kinds of modifications, of course falling within the scope of the claims following hereafter, remain possible. Thus, it will, for example, be possible to install a plurality of milking boxes, with a plurality of computers, optionally a separate computer for the feeding system and for the milking robot. Several computers may be integrated in a complete computer system.

CLAIMS

1. A construction including an implement for milking animals, such as cows, having one or more milking boxes (1), at least one automatic feeding system (5) and at least one animal identification system (11, 12) connected to a computer means (4), characterized in that, during the milking of an animal, a quantity of fodder, adjusted to said animal, is automatically supplied to said animal by a computer-controlled feeding system.
2. A construction as claimed in claim 1, characterized in that the quantity of fodder adjusted to the animal is supplied such that the flow of fodder is interrupted as little as possible.
3. A construction as claimed in claim 1, characterized in that the control is such that the quantity of fodder to be supplied to an animal is fed in such a manner that it is automatically distributed over the expected milking period.
4. A construction including an implement for milking animals, such as cows, having one or more milking boxes (1), at least one automatic feeding system (5) and at least one animal identification system (11, 12) connected to a computer means (4), characterized in that the quantity of fodder to be supplied to an animal is automatically distributed over the expected milking period by a computer-controlled feeding system.
5. A construction as claimed in any one of the preceding claims, characterized in that a milking robot (6) includes detection means (13) for determining the position of the teats, and that the control is such that fodder is fed to an animal as soon as the position of the teats has been determined and/or the teat cups (16) are connected to the teats.
6. A construction including an implement for milking animals, such as cows, having one or more milking boxes (1), at least one automatic feeding system (5), at least one animal identification system (11, 12) connected to a computer means (4) and one or more milking robots (6) for automatically connecting teat cups (16) to the teats of the animals, and

being provided with detection means (13) for determining the position of the teats, characterized in that the computer-controlled feeding system provides that fodder is fed to an animal as soon as the position of the teats has been detected by detection means (4) and/or the teat cups (16) are connected to the teats.

7. A construction as claimed in any one of the preceding claims, characterized in that the control is such that, when connecting of the teat cups (16) takes more time than is customary for the milking robot (6), an animal automatically receives a quantity of fodder that is adapted to the prolonged period of time it has to stay in a milking box (1).

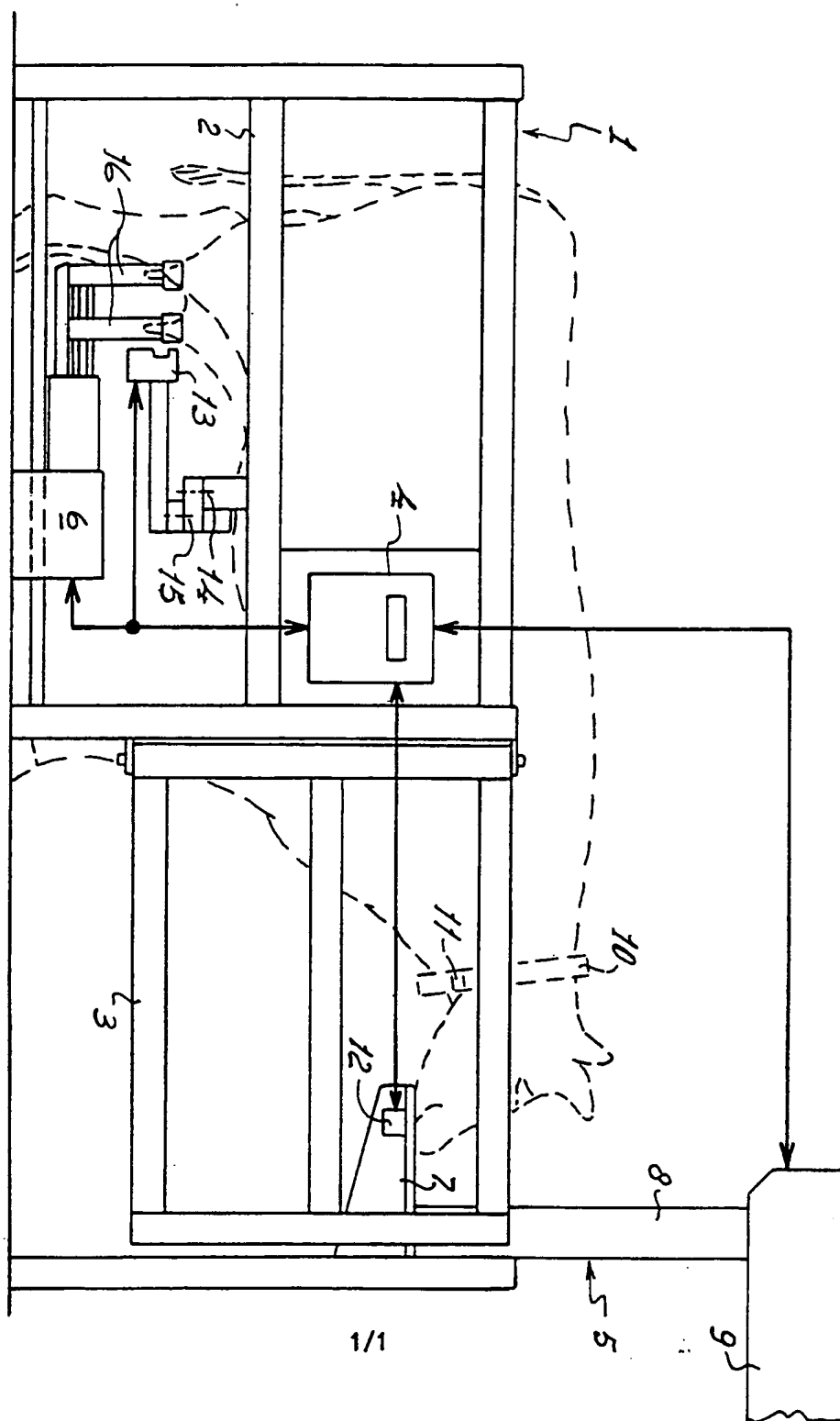
8. A construction including an implement for milking animals, such as cows, having one or more milking boxes (1), at least one automatic feeding system (5), at least one animal identification system (11, 12) connected to a computer means (4) and one or more milking robots (6) for automatically connecting teat cups (16) to the teats of the animals, characterized in that the computer-controlled feeding is such that, when connecting the teat cups (16) takes more time than is customary for the milking robot (6), the animal automatically receives a quantity of fodder that is adapted to the prolonged period of time it has to stay in a milking box (1).

9. A construction as claimed in any one of the preceding claims, characterized in that it is stored in the computer (4) which animals proved to be difficult to milk in previous milkings, and that said animals are milked or allowed access to a milking box (1) only or at least as much as possible during preferential hours, e.g. during daytime.

10. A construction including an implement for milking animals, such as cows, having one or more milking boxes (1), at least one automatic feeding system (5), at least one animal identification system (11, 12) connected to a computer means (4) and one or more milking robots (6) for automatically connecting teat cups (16) to the teats of the animals, characterized in that in the computer (4) it is stored which animals proved to be difficult to milk in previous milkings,

and that said animals are milked or allowed access to a milking box (1) only or at least as much as possible during preferential hours, e.g. during daytime.

- 5 11. A construction as claimed in one or more of the preceding claims and/or as shown in the description and the drawing.



INTERNATIONAL SEARCH REPORT

Intern al Application No

PCT/NL 95/00217

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A01J5/017 A01K1/12 A01K5/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A01J A01K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	NL,A,9 200 095 (VAN DER LELY) 16 August 1993 see page 3, line 7 - page 4, line 17 see page 5, line 14 - line 30 see page 8, line 35 - page 10, line 35 see claims; figures & DATABASE WPI Section PQ, Week 9336, Derwent Publications Ltd., London, GB; Class P13, AN 93-285894 & NL,A,9 200 095 (VAN DER LELY) see abstract ---	1,5,6,11
X	EP,A,0 091 892 (ALFA-LAVAL) 19 October 1983 see page 2, line 10 - line 31 see page 5, line 24 - line 28 see claims; figures --- -/-	1,6,11

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- * "A" document defining the general state of the art which is not considered to be of particular relevance
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- * "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * "&" document member of the same patent family

Date of the actual completion of the international search

11 August 1995

Date of mailing of the international search report

14.11.95

Name and mailing address of the ISA

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PIRIOU, J

INTERNATIONAL SEARCH REPORT

International Application No
PCT/NL 95/00217

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 332 230 (VAN DER LELY) 13 September 1989 see column 1, line 7 - line 26 see column 6, line 48 - column 7, line 45 see claims; figures ---	1,6,11
X	EP,A,0 555 895 (VAN DER LELY) 18 August 1993 see column 2, line 26 - line 48 see column 8, line 23 - column 10, line 16 see claims; figures ---	1,11
A	GB,A,1 240 108 (GASCOIGNES) 21 July 1971 see page 1, line 12 - line 71 see claims; figures -----	1,2,11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/NL95/00217

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. Claims: 1-9 and 11 as far as related to 1-9
2. Claims: 10 and 11 as far as related to 10

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-9 and 11 as far as related to 1-9

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest.

☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

Inter: nal Application No

PCT/NL 95/00217

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
NL-A-9200095	16-08-93	NONE	
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INTERNATIONAL SEARCH REPORT

Internal Application No	
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PCT/NL 95/00217

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
GB-A-1240108	21-07-71	NONE	